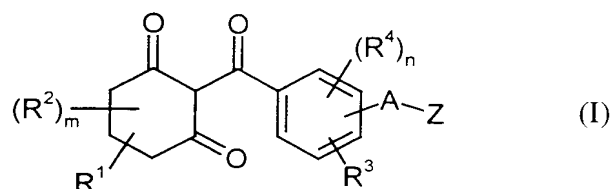


Patent Claims

1. Substituted benzoylcyclohexanediones of the general formula (I),



in which

m represents the numbers 0, 1, 2 or 3,

n represents the numbers 0, 1, 2 or 3,

A represents the single bond or represents alkanediyl (alkylene),

R¹ represents hydrogen or represents in each case optionally substituted alkyl or alkoxycarbonyl,

R² represents optionally substituted alkyl, or together with R¹ represents alkanediyl (alkylene) where in this case m represents 1 and R¹ and R² are located at the same carbon atom ("geminal") or at two adjacent carbon atoms ("vicinal"),

R³ represents hydrogen, nitro, cyano, carboxyl, carbamoyl, thiocarbamoyl, halogen, or represents in each case optionally substituted alkyl, alkoxy, alkylthio, alkylsulphinyl, alkylsulphonyl, alkylamino, dialkylamino or dialkylaminosulphonyl.

R⁴ represents nitro, cyano, carboxyl, carbamoyl, thiocarbamoyl, halogen, or represents in each case optionally substituted alkyl, alkoxy, alkylthio, alkylsulphinyl, alkylsulphonyl, alkylamino, dialkylamino or dialkylaminosulphonyl, and

5

Z represents an optionally substituted 4- to 12-membered, saturated or unsaturated, monocyclic or bicyclic, heterocyclic grouping which contains 1 to 4 heteroatoms (up to 4 nitrogen atoms and, if appropriate, - alternatively or additionally - one oxygen atom or one sulphur atom, or one SO grouping or one SO₂ grouping), and which additionally contains one to three oxo groups (C=O) and/or thioxo groups (C=S) as components of the heterocycle,

10

including all possible tautomeric forms of the compounds of the general formula (I) and the possible salts of the compounds of the general formula (I).

15

2. Substituted benzoylcyclohexanediones according to Claim 1, characterized in that

20

m represents the numbers 0, 1 or 2,

n represents the numbers 0, 1 or 2,

25

A represents a single bond or represents alkanediyl (alkylene) having 1 to 4 carbon atoms,

R¹ represents hydrogen, represents optionally halogen-, C₁-C₄-alkoxy-, C₁-C₄-alkylthio-, C₁-C₄-alkylsulphinyl- or C₁-C₄-alkylsulphonyl-substituted alkyl having 1 to 6 carbon atoms or represents alkoxy-carbonyl having up to 6 carbon atoms.

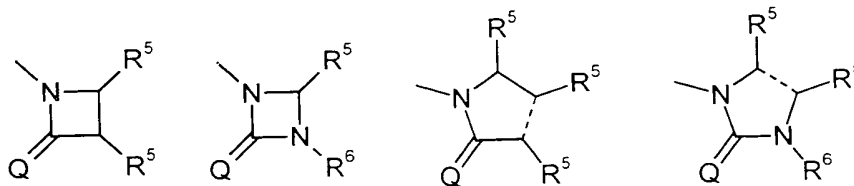
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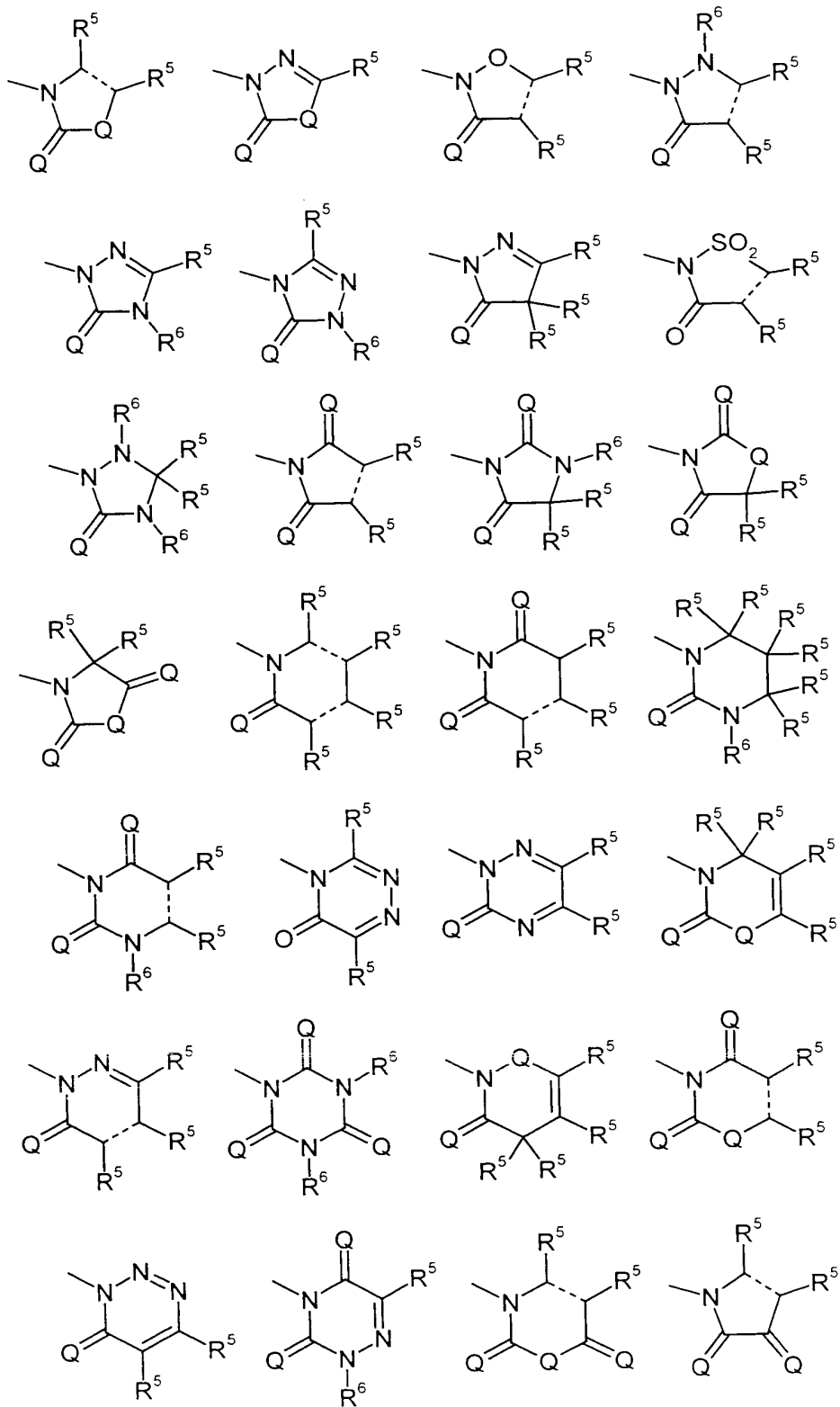
R² represents optionally halogen-substituted alkyl having 1 to 6 carbon atoms, or together with R¹ represents alkanediyl (alkylene) having 2 to 5 carbon atoms, where in this case m represents 1 and R¹ and R² are located at the same carbon atom ("geminal") or at two adjacent carbon atoms ("vicinal"),

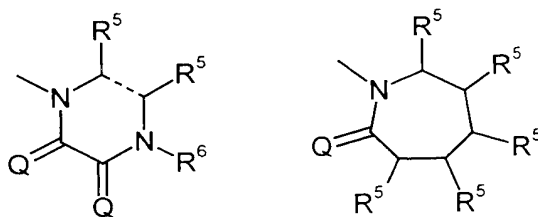
R³ represents hydrogen, nitro, cyano, carboxyl, carbamoyl, thiocarbamoyl, halogen, represents in each case optionally halogen-, C₁-C₄-alkoxy-, C₁-C₄-alkylthio-, C₁-C₄-alkylsulphinyl- or C₁-C₄-alkylsulphonyl-substituted alkyl, alkoxy, alkylthio, alkylsulphinyl or alkylsulphonyl having in each case up to 4 carbon atoms in the alkyl groups, or represents alkylamino, dialkylamino or dialkylaminosulphonyl having in each case up to 4 carbon atoms in the alkyl groups,

R⁴ represents nitro, cyano, carboxyl, carbamoyl, thiocarbamoyl, halogen, represents in each case optionally halogen-, C₁-C₄-alkoxy-, C₁-C₄-alkylthio-, C₁-C₄-alkylsulphinyl- or C₁-C₄-alkylsulphonyl-substituted alkyl, alkoxy, alkylthio, alkylsulphinyl or alkylsulphonyl having in each case up to 4 carbon atoms in the alkyl groups, or represents alkylamino, dialkylamino or dialkylaminosulphonyl having in each case up to 4 carbon atoms in the alkyl groups, and

Z represents one of the heterocyclic groupings below







in which the bond drawn broken in each case denotes a single bond or a double bond,

Q represents oxygen or sulphur,

R⁵ represents hydrogen, hydroxyl, mercapto, cyano, halogen, represents in each case optionally halogen-, C₁-C₄-alkoxy-, C₁-C₄-alkylthio-, C₁-C₄-alkylsulphinyl- or C₁-C₄-alkylsulphonyl-substituted alkyl, alkylcarbonyl, alkoxy, alkoxy-carbonyl, alkylthio, alkylsulphinyl or alkylsulphonyl having in each case up to 6 carbon atoms in the alkyl groups, represents in each case optionally halogen-substituted alkylamino or dialkylamino having in each case up to 6 carbon atoms in the alkyl groups, represents in each case optionally halogen-substituted alkenyl, alkynyl, alkenyloxy, alkenylthio or alkenyl-amino having in each case up to 6 carbon atoms in the alkenyl or alkynyl groups, represents in each case optionally halogen-substituted cycloalkyl, cycloalkylalkyl, cycloalkyloxy, cycloalkylthio or cycloalkylamino having in each case 3 to 6 carbon atoms in the cycloalkyl groups and optionally up to 4 carbon atoms in the alkyl moiety, or represents in each case optionally halogen-, C₁-C₄-alkyl- or C₁-C₄-alkoxy-substituted phenyl, phenyloxy, phenylthio, phenylamino, benzyl, benzyloxy, benzylthio or benzylamino, and

5 R^6 represents hydrogen, hydroxyl, amino, alkylideneamino having up to 4 carbon atoms, represents in each case optionally halogen- or C_1 - C_4 -alkoxy-substituted alkyl, alkoxy, alkyl-amino, dialkylamino or alkanoylamino having in each case up to 6 carbon atoms in the alkyl groups, represents in each case optionally halogen-substituted alkenyl, alkynyl or alkenyloxy having in each case up to 6 carbon atoms in the alkenyl or alkynyl groups, represents in each case optionally halogen-substituted cycloalkyl, cycloalkylalkyl or cycloalkylamino having in each case 3 to 6 carbon atoms in the cycloalkyl groups and optionally up to 3 carbon atoms in the alkyl moiety, or represents in each case optionally halogen-, C_1 - C_4 -alkyl- or C_1 - C_4 -alkoxy-substituted phenyl or benzyl, or together with an adjacent radical R^5 or R^6 represents optionally halogen- or C_1 - C_4 -alkyl-substituted alkanediyl having 3 to 5 carbon atoms, or - in the case that two adjacent radicals R^5 and R^5 are located at a double bond - together with the adjacent radical R^5 also represents a benzo grouping.

20 3. Substituted benzoylcyclohexanediones according to Claim 1, characterized in that

m represents the numbers 0, 1 or 2,

25 n represents the numbers 0, 1 or 2,

A represents a single bond, methylene, ethylidene (ethane-1,1-diyl) or dimethylene (ethane-1,2-diyl),

30 R^1 represents hydrogen, represents in each case optionally fluorine-, chlorine-, methoxy-, ethoxy-, n- or i-propoxy-, methylthio-, ethylthio-.

n- or i-propylthio-, methylsulphinyl-, ethylsulphinyl-, n- or i-propylsulphinyl-, methylsulphonyl-, ethylsulphonyl-, n- or i-propylsulphonyl-substituted methyl, ethyl, n- or i-propyl, n-, i- or s-butyl, or represents methoxycarbonyl, ethoxycarbonyl, n- or i-propoxycarbonyl,

5

R² represents methyl, ethyl, n- or i-propyl, or together with R¹ represents methylene, ethane-1,1-diyl (ethylidene, -CH(CH₃)-), ethane-1,2-diyl (dimethylene, -CH₂CH₂-), propane-1,3-diyl (trimethylene, -CH₂CH₂CH₂-), butane-1,4-diyl (tetramethylene, -CH₂CH₂CH₂CH₂-) or pentane-1,5-diyl (pentamethylene, -CH₂CH₂CH₂CH₂CH₂-), where in this case m represents 1 and R¹ and R² are located at the same carbon atom ("geminal") or at two adjacent carbon atoms ("vicinal"),

10

R³ represents hydrogen, nitro, cyano, carboxyl, carbamoyl, thio-carbamoyl, fluorine, chlorine, bromine, represents in each case optionally fluorine- and/or chlorine-, methoxy-, ethoxy-, n- or i-propoxy-, methylthio-, ethylthio-, n- or i-propylthio-, methylsulphinyl-, ethylsulphinyl-, methylsulphonyl- or ethylsulphonyl-substituted methyl, ethyl, n- or i-propyl, n-, i-, s- or t-butyl, represents in each case optionally fluorine- and/or chlorine-, methoxy-, ethoxy-, n- or i-propoxy-substituted methoxy, ethoxy, n- or i-propoxy, represents in each case optionally fluorine- and/or chlorine-substituted methylthio, ethylthio, n- or i-propylthio, methylsulphinyl, ethylsulphinyl, n- or i-propylsulphinyl, methylsulphonyl, ethylsulphonyl, n- or i-propylsulphonyl, or represents methylamino, ethylamino, n- or i-propylamino, dimethylamino, diethylamino, dimethylaminosulphonyl or diethylaminosulphonyl,

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R⁴ represents nitro, cyano, carboxyl, carbamoyl, thiocarbamoyl, fluorine, chlorine, bromine, represents in each case optionally fluorine- and/or chlorine-, methoxy-, ethoxy-, n- or i-propoxy-, methylthio-, ethylthio-,

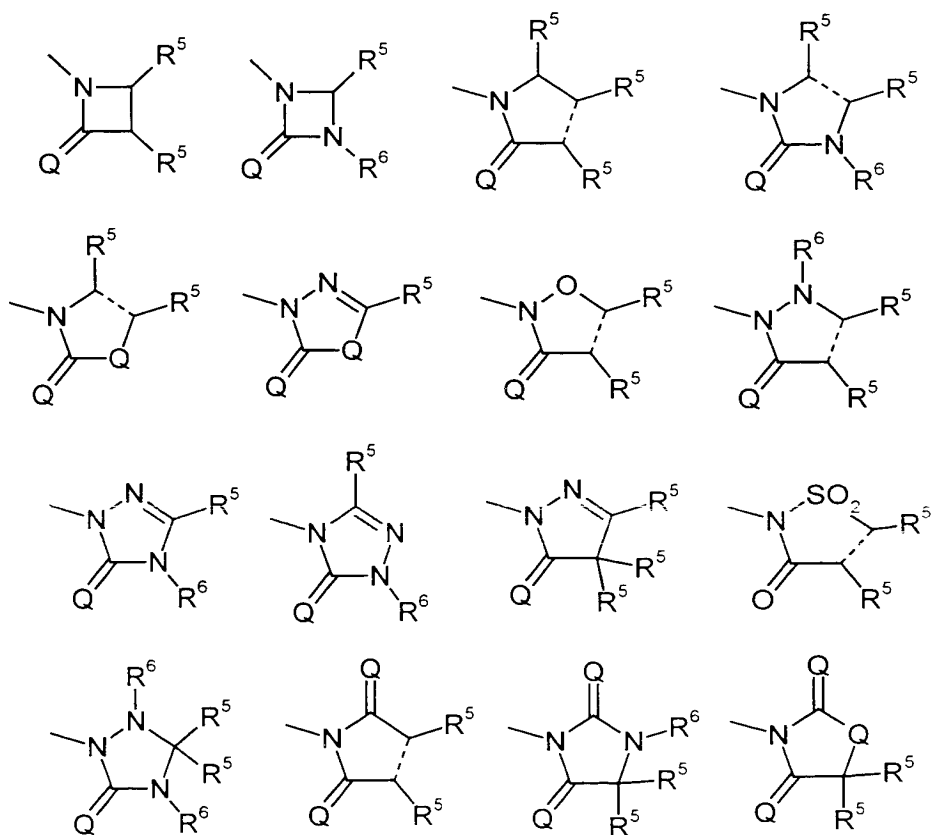
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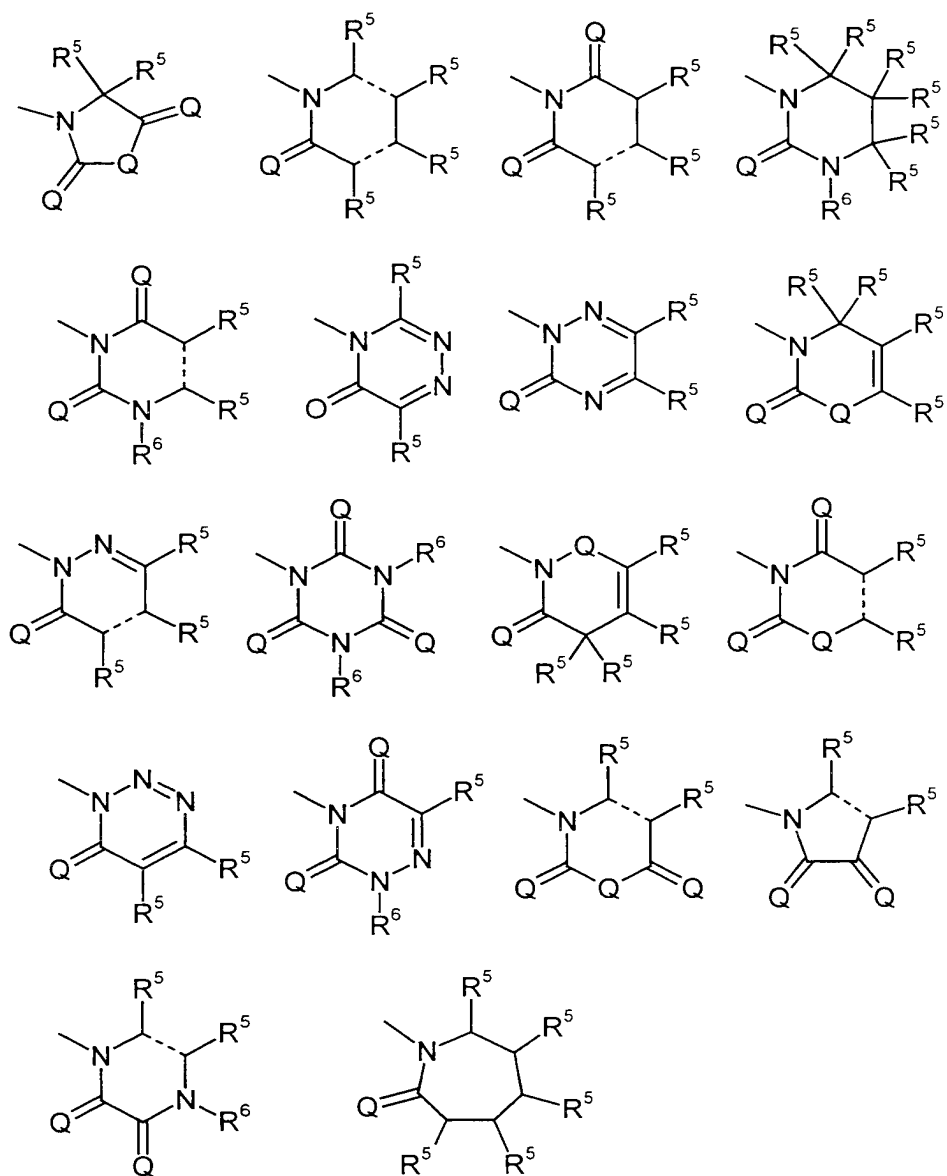
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n- or i-propylthio-, methylsulphinyl-, ethylsulphinyl-, methylsulphonyl- or ethylsulphonyl-substituted methyl, ethyl, n- or i-propyl, n-, i-, s- or t-butyl, represents in each case optionally fluorine- and/or chlorine-, methoxy-, ethoxy-, n- or i-propoxy-substituted methoxy, ethoxy, n- or i-propoxy, represents in each case optionally fluorine- and/or chlorine-substituted methylthio, ethylthio, n- or i-propylthio, methylsulphinyl, ethylsulphinyl, n- or i-propylsulphinyl, methylsulphonyl, ethylsulphonyl, n- or i-propylsulphonyl, or represents methylamino, ethylamino, n- or i-propylamino, dimethylamino, diethylamino, dimethylaminosulphonyl or diethylaminosulphonyl, and

Z represents one of the heterocyclic groupings below





in which the bond drawn broken in each case denotes a single bond or a double bond,

Q represents oxygen or sulphur,

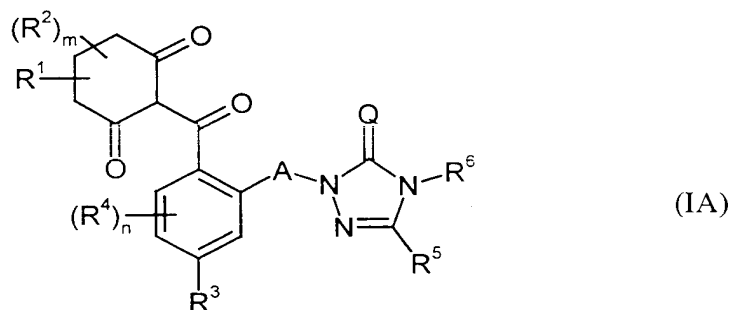
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R⁵ represents hydrogen, hydroxyl, mercapto, cyano, fluorine, chlorine, bromine, iodine, represents in each case optionally

- 5 fluorine-, chlorine-, methoxy-, ethoxy-, n- or i-propoxy-, n-, i-, s- or t-butoxy-, methylthio-, ethylthio-, n- or i-propylthio-, n-, i-, s- or t-butylthio-, methylsulphinyl-, ethylsulphinyl-, n- or i-propylsulphinyl-, methylsulphonyl-, ethylsulphonyl-, n- or i-propylsulphonyl-substituted methyl, ethyl, n- or i-propyl, n-, i-, s- or t-butyl, methoxy, ethoxy, n- or i-propoxy, n-, i-, s- or t-butoxy, methylthio, ethylthio, n- or i-propylthio, n-, i-, s- or t-butylthio, methylsulphinyl, ethylsulphinyl, n- or i-propylsulphinyl, methylsulphonyl, ethylsulphonyl, n- or i-propylsulphonyl, represents methylamino, ethylamino, n- or i-propylamino, n-, i-, s- or t-butylamino, dimethylamino, diethylamino, di-n-propylamino or di-i-propylamino, represents in each case optionally fluorine- and/or chlorine-substituted ethenyl, propenyl, butenyl, ethinyl, propinyl, butinyl, propenyloxy, butenyloxy, propenylthio, butenylthio, propenylamino or butenylamino, represents in each case optionally fluorine- and/or chlorine-substituted cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cyclopropylmethyl, cyclobutylmethyl, cyclopentylmethyl, cyclohexylmethyl, cyclopropyloxy, cyclobutyloxy, cyclopentyloxy, cyclohexyloxy, cyclopropylthio, cyclobutylthio, cyclopentylthio, cyclohexylthio, cyclopropylamino, cyclobutylamino, cyclopentylamino or cyclohexylamino, or represents in each case optionally fluorine-, chlorine-, methyl-, ethyl-, n- or i-propyl-, n-, i-, s- or t-butyl-, methoxy-, ethoxy-, n- or i-propoxy-substituted phenyl, phenyloxy, phenylthio, phenylamino, benzyl, benzyloxy, benzylthio or benzylamino, and
- 10
- 15
- 20
- 25
- 30 R⁶ represents hydrogen, hydroxyl, amino, represents in each case optionally fluorine- and/or chlorine-, methoxy-, or ethoxy-substituted methyl, ethyl, n- or i-propyl, n-, i- or s-butyl,

methoxy, ethoxy, n- or i-propoxy, methylamino, ethylamino or dimethylamino, represents in each case optionally fluorine- and/or chlorine-substituted ethenyl, propenyl, ethinyl, propinyl or propenyloxy, represents in each case optionally fluorine- and/or chlorine-substituted cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cyclopropylmethyl, cyclobutylmethyl, cyclopentylmethyl, cyclohexylmethyl, or represents in each case optionally fluorine-, chlorine-, methyl-, ethyl-, n- or i-propyl-, n-, i-, s- or t-butyl-, methoxy-, ethoxy-, n- or i-propoxy-substituted phenyl or benzyl, or together with an adjacent radical R^5 or R^6 represents in each case optionally methyl- and/or ethyl-substituted propane-1,3-diyl (trimethylene) or butane-1,4-diyl (tetramethylene), or - in the case that two adjacent radicals R^5 and R^5 are located at a double bond - together with the adjacent radical R^5 also represents a benzo grouping.

4. Substituted benzoylcyclohexanediones according to Claim 1, characterized by the general formula (IA),

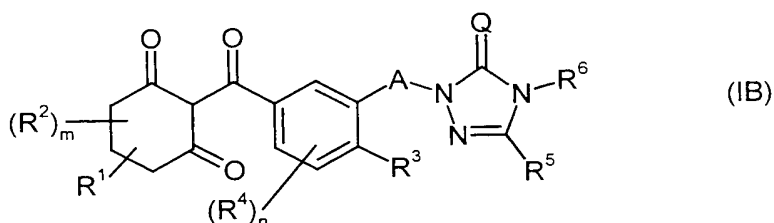


in which

m represents the numbers 0, 1 or 2,

- n represents the numbers 0, 1 or 2,
- A represents a single bond or represents methylene,
- 5 Q represents oxygen or sulphur,
- R¹ represents hydrogen, methyl, ethyl, n- or i-propyl,
- R² represents methyl,
- 10 R³ represents hydrogen, nitro, cyano, fluorine, chlorine, bromine, methyl, ethyl, trifluoromethyl, methoxymethyl, methylthiomethyl, methylsulphinylmethyl, methylsulphonylmethyl, methoxy, ethoxy, difluoromethoxy, trifluoromethoxy, methylthio, ethylthio, methylsulphinyl, ethylsulphinyl, methylsulphonyl, ethylsulphonyl or dimethylamino-
- 15 sulphonyl,
- R⁴ represents nitro, cyano, fluorine, chlorine, bromine, methyl, ethyl, trifluoromethyl, methoxymethyl, methylthiomethyl, methylsulphinyl-
- 20 methyl, methylsulphonylmethyl, methoxy, ethoxy, difluoromethoxy, trifluoromethoxy, methylthio, ethylthio, methylsulphinyl, ethylsulphinyl, methylsulphonyl, ethylsulphonyl or dimethylamino-
- sulphonyl,
- 25 R⁵ represents methyl, ethyl, n- or i-propyl, trifluoromethyl, methoxy, ethoxy, n- or i-propoxy, methylthio, ethylthio, n- or i-propylthio, methylsulphinyl, ethylsulphinyl, n- or i-propylsulphinyl, methylsulphonyl, ethylsulphonyl, n- or i-propylsulphonyl, or represents cyclopropyl, and
- 30 R⁶ represents methyl, ethyl, methoxy, ethoxy or cyclopropyl.

5. Substituted benzoylcyclohexanediones according to Claim 1, characterized by the general formula (IB),



in which

in which

10

m represents the numbers 0, 1 or 2,

n represents the numbers 0, 1 or 2,

A represents a single bond or represents methylene,

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Q represents oxygen or sulphur,

R^1 represents hydrogen, methyl, ethyl, *n*- or *i*-propyl,

20

R^2 represents methyl,

R^3 represents hydrogen, nitro, cyano, fluorine, chlorine, bromine, methyl, ethyl, trifluoromethyl, methoxymethyl, methylthiomethyl, methylsulphinylmethyl, methylsulphonylmethyl, methoxy, ethoxy, difluoromethoxy, trifluoromethoxy, methylthio, ethylthio, methylsulphinyl, ethylsulphinyl, methylsulphonyl, ethylsulphonyl or dimethylamino-sulphonyl,

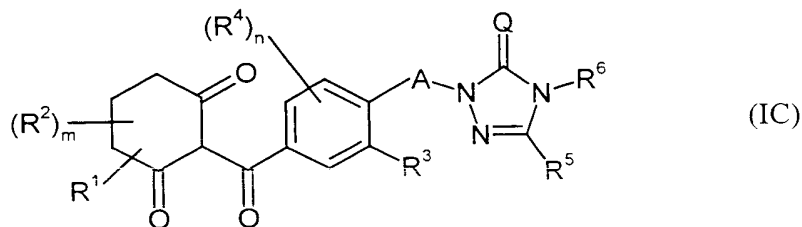
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R⁴ represents nitro, cyano, fluorine, chlorine, bromine, methyl, ethyl, trifluoromethyl, methoxymethyl, methylthiomethyl, methylsulphinyl-methyl, methylsulphonylmethyl, methoxy, ethoxy, difluoromethoxy, trifluoromethoxy, methylthio, ethylthio, methylsulphinyl, ethylsulphinyl, methylsulphonyl, ethylsulphonyl or dimethylamino-sulphonyl,

R⁵ represents methyl, ethyl, n- or i-propyl, trifluoromethyl, methoxy, ethoxy, n- or i-propoxy, methylthio, ethylthio, n- or i-propylthio, methylsulphinyl, ethylsulphinyl, n- or i-propylsulphinyl, methylsulphonyl, ethylsulphonyl, n- or i-propylsulphonyl, or represents cyclopropyl, and

R⁶ represents methyl, ethyl, methoxy, ethoxy or cyclopropyl.

6. Substituted benzoylcyclohexanediones according to Claim 1, characterized by the general formula (IC),



in which

m represents the numbers 0, 1 or 2,

n represents the numbers 0, 1 or 2,

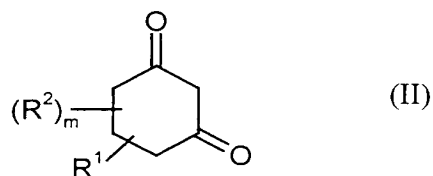
A represents a single bond or represents methylene.

- Q represents oxygen or sulphur,
- 5 R¹ represents hydrogen, methyl, ethyl, n- or i-propyl,
- R² represents methyl,
- 10 R³ represents hydrogen, nitro, cyano, fluorine, chlorine, bromine, methyl, ethyl, trifluoromethyl, methoxymethyl, methylthiomethyl, methylsulphinylmethyl, methylsulphonylmethyl, methoxy, ethoxy, difluoromethoxy, trifluoromethoxy, methylthio, ethylthio, methylsulphinyl, ethylsulphinyl, methylsulphonyl, ethylsulphonyl or dimethylamino-sulphonyl,
- 15 R⁴ represents nitro, cyano, fluorine, chlorine, bromine, methyl, ethyl, trifluoromethyl, methoxymethyl, methylthiomethyl, methylsulphinylmethyl, methylsulphonylmethyl, methoxy, ethoxy, difluoromethoxy, trifluoromethoxy, methylthio, ethylthio, methylsulphinyl, ethylsulphinyl, methylsulphonyl, ethylsulphonyl or dimethylamino-sulphonyl,
- 20 R⁵ represents methyl, ethyl, n- or i-propyl, trifluoromethyl, methoxy, ethoxy, n- or i-propoxy, methylthio, ethylthio, n- or i-propylthio, methylsulphinyl, ethylsulphinyl, n- or i-propylsulphinyl, methylsulphonyl, ethylsulphonyl, n- or i-propylsulphonyl, or represents cyclopropyl, and
- 25 R⁶ represents methyl, ethyl, methoxy, ethoxy or cyclopropyl.
- 30 7. Substituted benzoylcyclohexanediones according to any of Claims 1 to 6, characterized in that the salts are the sodium, potassium, magnesium, calcium.

ammonium, C₁-C₄-alkyl-ammonium, di-(C₁-C₄-alkyl)-ammonium, tri-(C₁-C₄-alkyl)-ammonium, tetra-(C₁-C₄-alkyl)-ammonium, tri-(C₁-C₄-alkyl)-sulphonium, C₅- or C₆-cycloalkyl-ammonium and di-(C₁-C₂-alkyl)-benzyl-ammonium salts.

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8. Process for preparing substituted benzoylcyclohexanediones according to any of Claims 1 to 6, characterized in that 1,3-cyclohexanedione or its derivatives of the general formula (II),



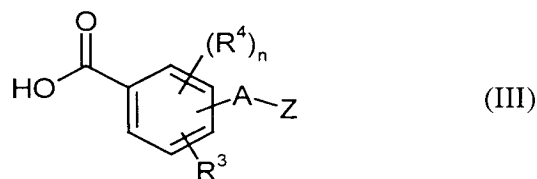
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in which

m, R¹ and R² are each as defined in any of Claims 1 to 6,

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are reacted with substituted benzoic acids of the general formula Formel (III),



in which

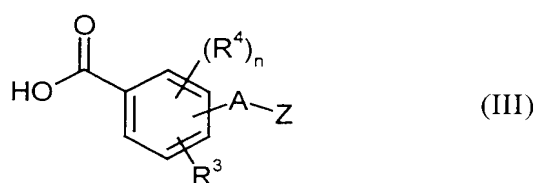
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n, A, R³, R⁴ and Z are each as defined in any of Claims 1 to 6,

in the presence of a dehydrating agent, if appropriate in the presence of one or more reaction auxiliaries and if appropriate in the presence of a diluent.

and, if appropriate, the compounds of the formula (I) obtained in this manner are subsequently subjected in a customary manner, within the scope of the definition of the substituents, to electrophilic or nucleophilic or oxidation or reduction reactions, or the compounds of the formula (I) are converted in a customary manner into salts.

9. Substituted benzoic acids of the general formula (III),



in which

n , A , R^3 , R^4 and Z are each as defined in any of Claims 1 to 6,

except for the compounds 2-(5-carboxy-2,4-dichloro-phenyl)-4-difluoromethyl-5-methyl-2,4-dihydro-3H-1,2,4-triazol-3-one and 2-(5-carboxy-2,4-dichloro-phenyl)-4,5-dimethyl-2,4-dihydro-3H-1,2,4-triazol-3-one.

10. Use of at least one substituted benzoylcyclohexanedione according to any of Claims 1 to 6 for controlling undesirable plants.
11. Herbicidal compositions, characterized in that they contain at least one substituted benzoylcyclohexanedione according to any of Claims 1 to 6 and customary extenders.